

DUNSTER (ED. S.)



A CASE OF FRACTURE OF THE HUMERUS; DEATH ON THE  
EIGHTEENTH DAY FROM FATTY DEGENERATION OF THE  
HEART; WITH REMARKS ON OSTEOGENESIS.

BY EDWARD S. DUNSTER, M. D., A. M.,

Professor of Obstetrics and Diseases of Women and Children in the University of Michigan and in Dartmouth College.

Reprinted from the April number of THE PHYSICIAN AND SURGEON, Ann Arbor, Michigan.

A gentleman, aged fifty-six years on the day of his death, was knocked down by a horse and sleigh driven at a rapid rate. The end of the shaft or thill struck him on the right arm just below the shoulder, and he was thrown somewhat forcibly to the ground, his right arm, which was extended to prevent the force of the fall, being underneath him. No part of the sleigh passed over him, nor was he trodden upon by the horse. He was not stunned by the force of either the blow or the fall, and on being assisted to rise, he was supposed to be not materially injured, and was conveyed to his residence in a carriage.

I saw him about an hour subsequent to the reception of the injury. He was pale; skin, especially of the extremities, was cold; pulse rapid (120) and small; there was a marked degree of prostration with some anxiety of countenance, heightened perhaps by the consciousness of an extensive though superficial bruise, and ecchymosis of the right side of the face and forehead. The right humerus was found to be fractured obliquely at about the junction of its upper and middle thirds. The muscles enveloping the fracture were in a state of clonic convulsion which was the cause of much annoyance and some pain. There was apparently no comminution of the bone, nor was any laceration of the soft tissues discoverable. On the outside of the arm, somewhat above the point of fracture, was a circular bruise about an inch in diameter, already ecchymotic and evidently caused by the blow from the end of the shaft as described above. A careful examination showed no other injuries, beyond a few slight superficial bruises of which no note was taken. The patient was put to bed, warmth and restoratives applied, and a temporary splint was adjusted to the arm after bandaging the same from the fingers up. Four hours later he was found in a comparatively comfortable condition, having recovered pleasantly from the shock, and complaining of but little pain. That night he was ordered a pill of opium, one-half grain, and extract of valerian two and one-half grains, to be repeated every two hours if necessary. By the aid of this, he secured a fair night's rest, and on the following morn-

ing felt as he expressed himself "all right." The rebellious muscles around the seat of the fracture were subdued by the pressure of the bandage, and were resting quietly in a comparatively flaccid condition. There was but little heat and swelling, at the point of injury; the pulse was still rapid, but altogether the case, so far as the injury was concerned, was as favorable as could be desired.

The details of the treatment of the fracture are not given, as they present nothing of interest or out of the usual experience met with in such cases. It should be noted, however, as bearing upon the condition of the fracture as found after death, that after the permanent splints were applied, the fragments retained a remarkable accurate apposition to each other, and that the movements at the point of fracture were reduced to an absolute minimum by the extreme carefulness of the patient and his disposition to quietude of body, which had been his habit for years.

His general condition was as follows: He suffered severely at times from acute lancinating pains variable in duration and shifting in position, but usually located in the neighborhood of the joints or over fibrous structures. By way of a euphemism, these pains were styled neuralgic, but in truth, they were dependent upon a syphilitic diathesis, for (as the family physician informed me), the patient had suffered severely from syphilis some twenty years back, and had received before he came under his—the physician's—observation, some pretty sharp treatment. Sleep at night was not very regular or refreshing, but this was in a measure compensated for by sleep during the day. The bowels were constipated, and on two occasions, unknown to me, the patient took a dose of Brandeth's pills, for which he had for some years manifested a decided partiality. These produced copious catharsis, and along with it a considerable degree of prostration. The upshot of this was a positive interdiction of all medication, except with my knowledge and consent. The appetite was variable, but by no means keen, and resort was had to tonics, with an allowance for each twenty-four hours of a bottle of ale with his dinner, and four ounces of whisky or gin in two portions. The pulse remained all through the treatment unusually weak and rapid, never falling below one hundred per minute. This condition of the pulse unattended as it was by any febrile condition, was the occasion of considerable anxiety, and was believed to indicate some grave disturbance of the circulatory system, possibly aneurism which was suspected, though nothing positive could be elicited by physical exploration several times repeated. By his family physician who for twenty-five years had been his medical adviser, it was attributed to the nervous excitement and prostration resulting from the injury superinduced on the syphilitic diathesis before mentioned.



Thus matters stood with a gradual, though perceptible decline of strength until seventeen days after the receipt of the injury, when I was called in haste at 7 P. M., to visit the patient, and found that he had apparently fainted, but had not entirely lost consciousness. He was lying on a lounge, his face preternaturally pale, but otherwise manifesting no anxiety; no difficulty of respiration; mind clear; and no complaint of pain, but with a pulse of one hundred and forty very feeble and small. *The first sound of the heart was not perceptible* on auscultation, and the impulse was very slight. No medication was ordered, but a stimulant of brandy toddy moderately strong was allowed, and absolute rest in the recumbent position was enjoined until I should visit him again at his hour of retiring, as I feared that the rising into an upright position might produce sudden syncope. Such, however, was not the result; for some three hours later he rose and walked unassisted to his bed in an adjoining room. The pulse at this time had fallen to one hundred and thirty, but was raised again by the movements just described. The following morning the pulse was one hundred and thirty-two, the patient then sitting up and in good spirits; complaining of a severe pain in the back of the head and neck; and occupied in the reading and dictating business letters to an amanuensis. About two hours after my visit, another "fainting turn" came on similar to that of the evening previous. He was again laid on the lounge, and in a short time was dead, breathing up to the moment of death being entirely unembarrassed.

Permission was obtained to make an incomplete examination of the body, and this was done forty-eight hours after death, the temperature of the apartment meanwhile ranging from eight degrees to twenty-two degrees above zero. In the pericardial cavity there were about two ounces of clear serum. The heart itself was of normal size, and was partially covered by a very thin layer of fat; the walls were extremely pale and flabby, and softened to such an extent that the finger could be easily pushed through them. The wall of the left ventricle was very thin, and could be torn almost by the weight of the organ itself; the right cavities were stained a deep brownish red color, but the lining membrane showed nowhere any roughening, or evidences of inflammatory action; the valves were healthy, and there were no atheromatous or ossific deposits. The lungs were healthy; the right one showing old pleuritic adhesions. No other organs were examined.

Under the microscope with a magnifying power of three hundred and fifty diameters, the muscular structure of the heart showed the most extreme fatty degeneration I have ever witnessed. Not a trace of the markings could be found after a careful and prolonged examination, but the whole structure of the fibre con-

sisted of granular and fatty matters. There were also extensive deposits of oil globules between the fibres.

The prevailing impression left by this examination was one of wonder that the patient with a heart in so extreme a degree of degeneration had not long ago died, as he most assuredly would have, had not his habits been of the kind above described. Rupture might readily have taken place on any unusual excitement, or sudden and violent movement or strain, and had he died at the moment of receiving the blow which caused the fracture, it would have elicited no surprise, when once this condition of the heart was known. Of course the bearing of the syphilitic diathesis on this kind of degeneration is evident, and well understood.

About four inches of the humerus including the seat of the fracture were removed. The principal interest attaching to the specimen, is in the opportunity it affords for observation of the process of repair in bones which have been broken. Examination shows numerous points of ossification in the periosteum, on the fractured surface, also in the medulla and the connective tissue outside the periosteum, and even in the adjacent muscular tissue. Many of these points of ossification have been examined microscopically, and found to be true bone tissue and not simply points of calcification; thus showing conclusively that bone may develop under certain conditions of irritation (perhaps not very well understood) wherever connective tissue is present. The bearing of this property on the reproduction of bone after surgical operations that involve the removal of bone and of periosteum is apparent. Surgical experience has long since demonstrated that Duhamel's theory of the production of bone from periosteum, enunciated in the last century (1739-1757), and partially accepted by Dupuytren, although pronounced untrue by such men as Haller, Bichat and Scarpa, is unquestionably correct. Outside of surgical experience, however, Flourens\* and subsequently Ollier,† in that remarkable series of experiments which gained for him the grand prize of the French Academy of Medicine, demonstrated that Duhamel's views were essentially correct and forced them into general acceptance. They would to-day scarcely need re-affirmation, but for the fact that Sedillot, the Strasbourg surgeon, who shared with Ollier the grand prize, has thrown all the weight of his eminent name against them.

\**Theorie Experimentale de la Formation des Os*. Par P. Flourens. Paris, 1847. See Review and Summary of this work in the *Medico-Chirurgical Review*, Volume LI, October, 1847, page 426.

†*Traité expérimentale et clinique de la Régénération des Os, et de la Production artificielle du Tissu osseux*. Par L. Ollier. Paris, 1867. Reviewed in *Edinburgh Medical Journal* for May, 1867, page 1039-1122, and in the *American Journal Medical Sciences*, for January, 1868, page 140. See also an excellent article on this subject by Dr. W. R. Whitehead, *New York Medical Journal*, Volume XI, June, 1870, page 376.



He asserts that when the periosteum is detached and isolated from the subjacent bone no growth of bone occurs. He makes a distinction between the periosteum proper and a hypothetical plastic tissue underneath it, but declares that for all surgical purposes they are practically one, and new bone will not be formed unless some portions of the old are left attached to the inner surface of the periosteum. On this he bases the advocacy of his well-known operation—*l'évidement des os*—the hollowing or scooping out of diseased bone. That this operation is valuable under some circumstances is doubtless true, but as to its congener—subperiosteal resection—it is quite unnecessary to quote the authorities, for the surgical records of to-day are full of instances of the absolute destruction and sequestration of bones in their continuity in which the structure has been renewed solely by the agency of the periosteal envelopes. It seems then to be a logical conclusion that subperiosteal resection is a good and safe surgical procedure, and I presume there are but few practical surgeons who would dispute this point.

The osteogenetic property of other tissues, medullary, connective and muscular, which is so beautifully illustrated in the specimen taken from this patient, is now generally conceded and may even be manifested in parts distant from bone though it is well known that the near presence of periosteal tissue sets up an increased tendency to the formation of bone. Of course this property is not of such great practical value in surgery as the allied power in periosteum, but its bearing on the repair of fractures especially in the long bones (as shown in the specimen before us) and more particularly its relation to certain well-known but rare pathological conditions is obvious enough. Such are the progressive ossification of the muscles; the costal osteophytes sometimes found in chronic pleurisy; bony deposits in the iris, etc. Deposits of calcareous salts which are not true ossification may also be found in tissues far away from the bones; such deposits as well as the true bony deposits being the result of chronic inflammation. The osteogenetic power of medullary tissue like that of the periosteum is not lost even when transplanted to distant parts, though of course we cannot avail ourselves practically of this power. Goujon\* in his experiments demonstrated this and showed at the same time that such newly formed tissue was very apt to disappear soon by absorption. This accounts for Ollier's failure to obtain bone from transplanted marrow because he waited too long after the transplantation before examining the animals experimented upon. This property of medullary tissue is now conceded to be next in activity and power to that of the periosteum, and hence it is of the greatest importance in the repair of fractures in the hollow

\* *Journal de l'Anatomie et de la Physiologie*, 1869, Number 4.

bones by the formation of what may, with propriety, perhaps, be called an intra-osseous splint.

Professor Feltz, of the medical faculty of Nancy, in some recent experiments upon the regeneration of bone has arrived at conclusions quite different from the generally accepted ones as given in the above brief and very general remarks. He holds that preliminary to the formation of bone, there is laid down by a process of direct genesis a soft grayish-white tissue\* which may be called embryonic. This tissue histologically is analogous to that found in the stumps of limbs in the fœtus in which the various anatomical tissues, whether temporary or permanent, develop themselves. This embryo-plastic tissue is not formed from the periosteum, for in the cases of scooping out, *évidement*, it is developed inside the bone itself, where it (the tissue alluded to) is separated from the periosteum by the osseous layers which are left undisturbed and which continue to live. Furthermore, in the cases of entire resection of the diaphyses of bones, if this tissue were of periosteal origin we must admit the preliminary formation of a periosteum and then an ossification passing from without inward. Can we attribute the embryonic tissue to proliferation of the bone marrow in the large and small Haversian canals? If this were so we ought to be able to show the absolute identity between young—newly formed—marrow and the tissue of which we are speaking, but neither the histological characters nor the chemical reactions permit any such assertion. Furthermore, if ossification were dependent upon the soft medulla reformed under the influence of the traumatic irritation, we can not readily comprehend why the new bone does not encroach both on the central medullary canal and on the Haversian canals which are opened in the sections and in which marrow reforms at the very outset of the work of reparation. Thus, excluding these sources as the origin of this embryo-plastic tissue, Dr Feltz, if we have rightly comprehended his views, suggests that it is the result of a direct genesis resulting from the traumatic irritation. Even this, however, it seems to us, fails to show the constant relation which must obtain between the embryo-plastic tissue, if any such exists, and the development in it of bone cells, so that it is necessary to introduce some additional factor which after all guides the development. May not this be, in accordance with the older views, the near presence of the periosteum or the medullary tissue? Dr. Feltz's views are so interesting that I have thought it advisable to add this brief summary of them even though they may not command ready assent. His paper is published in the *Journal de l'Anatomie et de la Physiologie*, 1876, page 375.

\*Haller long ago taught that in the formation of bone there is first a jelly-like tissue which gradually changes into bone passing through the stage of cartilage. Is not this identical with Feltz' embryonic or embryo-plastic deposit?